

REMARKS

Favorable reconsideration of the above-identified application is requested in view of the following remarks.

Claim 1 is canceled by this amendment. Thus, Claims 2-20 are pending in this application, with Claims 2, 5, 10, 15, 16, 19 and 20 being independent.

The Examiner is thanked for indicating that Claims 5-7 and 16 define allowable subject matter and would be allowable if rewritten in independent form. Claims 5 and 16 are amended to be in independent form and are therefore allowable. Claims 6 and 7 are allowable at least by virtue of their dependence from Claim 5.

The Official Action rejects Claims 1-4, 8-15 and 17-20 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,862,257, hereinafter *Suzuki*, in view of U.S. Patent No. 6,408,109, hereinafter *Silver*.

An aspect of the presently claimed subject matter includes features generally directed toward an image processor that processes grayscale image data on density levels of pixels. An edge judgment circuit discriminates an edge direction of a target pixel from differences in density level between the target pixel and adjacent pixels thereof based upon the grayscale image data. A density level determining circuit determines grayscale density levels in a plurality of sub-pixels in the target pixel, where the target pixel is divided into the sub-pixels, in accordance with the density level of the target pixel and the edge direction of the target pixel discriminated by the edge judgment circuit. These features are presently included in Claims 2, 10, 19 and 20, together with the other claimed features. Claim 15 defines a method including edge direction of a target pixel that is discriminated from differences in density level

between the target pixel and adjacent pixels thereof based upon the grayscale image data. Grayscale density levels in a plurality of sub-pixels in the target pixel are determined in accordance with the density level of the target pixel and the discriminated edge direction of the target pixel.

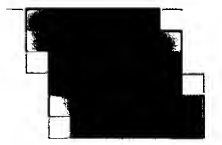
The Official Action relies on *Suzuki* to disclose every claimed feature except those directed toward an edge judgment circuit that discriminates an edge of a target pixel from differences in density level between the target pixel and adjacent pixels thereof based upon grayscale image data, and relies on *Silver* for a disclosure of such.

Suzuki discloses a graphic data processing apparatus for removing the jags of edges in vector data. *Suzuki* accomplishes that by using a method known as antialias treatment. Antialias treatment corrects the staircase feature of images, i.e., jagged edges, by filling in the sharp edges with pixels having densities somewhere between the image and the background. The result is a value that is applied to the entire pixel, that value being somewhere between the density of the image and that of the background. Basically, antialias treatment modifies the pixel density based on the percentage of the pixel that is in the image. An example is shown below. Notice that the correction is due to entire pixels having lower densities that serve to blend the edge of the image.

Non-Treated



Treated with Antialias



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Beginning in column 5, *Suzuki* describes some variations of antialias treatment. One type of antialias treatment is called uniform averaging (column 4, line 66). As shown in Figs. 2A and 2B, the edge of an image transverses a pixel. First, the pixel is divided into sub-pixels (7 x 7). Second, the sub-pixels in the image are counted (28). Third, the sub-pixels in the image (28) are divided by the total number of sub-pixels (49), to give .571. Fourth, the maximum displayable luminance (255) is multiplied by .571 to give the luminance that is applied to the pixel.

A second type of antialias treatment is called the weighted averaging approach (column 5, line 25). This approach is similar to the uniform average approach, except that each pixel has a weighted value. Therefore, instead of adding up the number of sub-pixels in the image, one adds the total weighted values of the sub-pixels in the image. For example, instead of counting a single sub-pixel having a weighted value of 8 as "1", it is counted as "8". The total weighted value of the sub-pixels in the image is then divided by the total weighted value of all the sub-pixels. The maximum displayed luminance of the pixel is then multiplied by the ratio (weighted value of sub-pixels in image/weighted value of sub-pixels in target pixel) to arrive at the luminance of the target pixel.

As seen above, *Suzuki* is very different from the claimed subject matter. *Suzuki* does not disclose at least determination of grayscale density levels in a plurality of sub-pixels in a target pixel, in accordance with the density level of the target pixel and the edge direction of the target pixel discrimination by the edge judgment circuit, in combination with the other features. In fact, the densities of the sub-pixels are never determined. Rather, only the density of the target pixel (not a sub-pixel) is determined, which is entirely different than the claimed subject matter.

Another claimed feature is directed toward the density data of the sub-pixels being determined by using a calculation for input gradation data with the parameters, the parameter for each pixel being determined based on the determined edge direction. This feature is presently included in Claims 2, 10, 15, 19 and 20. As noted above, neither *Suzuki* nor *Silver* discloses determination of the density data of sub-pixels.

Claims 10, 19 and 20 also define that a smoothing circuit performs smoothing on image data of a pixel, on which the edge judgment circuit discriminates an edge, by using an asymmetric filter. The Official Action relies on *Silver* for a disclosure of this feature. However, *Silver* only shows an asymmetric filter being used to detect edges, and not for smoothing. Claim 15 includes features directed toward the corresponding method. Therefore, Claims 10, 15, 19 and 20 are allowable.

For at least the above reasons, *Suzuki* does not disclose the claimed subject matter for which it is relied upon, and *Silver* does not satisfy those deficiencies. Therefore, Claims 2, 10, 15, 19 and 20 are allowable. Also, Claims 3, 4, 8-14, 17 and 18 are allowable at least by virtue of their dependence from allowable independent claims, and because they define features that further distinguish over the cited disclosures.

For example, Claim 11 defines a combination including features directed toward setting a density level for each of a plurality of sub-regions in the target pixel based upon the density level of the target pixel smoothed by the smoothing circuit by using the parameters set by the density controller circuit. As noted above, neither *Suzuki* nor *Silver* discloses setting density levels of sub-regions of a target pixel.

Claim 12 defines a combination of features including a filter that is asymmetrical with respect to a direction perpendicular to which a pixel is divided into sub-pixels. The Official Action points to Figs. 1A-1D, and column 6, lines 30-63 to disclose that feature, however, those sections only disclose that Roberts kernels 111, 112 estimate a gradient in a direction 45 degrees to the axes of the pixel grid, and that Sobel kernels 131, 132, 133 estimate a gradient in three directions spaced 60 degrees apart. That is, this portion of *Silver* discloses estimation of a gradient, not a filter as defined by Claim 12. Should this rejection be maintained, it is requested that it be specifically shown where or how *Silver* discloses the subject matter defined by Claim 12.

Claim 13 defines a smoothing circuit that comprises a plurality of filters and selects one of them for smoothing. Once again, the Official Action relies on Figs. 1A-1D and column 6, lines 30-63 for a disclosure of such subject matter. As noted above, these portions of *Silver* are directed to detection of a gradient, not a smoothing circuit as claimed.

Claim 14 defines a smoothing circuit that comprises a plurality of filters and selects one of the filters which provides a minimum density level of the target pixel after the smoothing carried by the filters. The Official Action relies on Figs. 1C and 1D and column 6, lines 51-63 for a disclosure of this subject matter. However, as noted above, that portion of *Silver* is directed toward detecting gradients and does not disclose a smoothing circuit as claimed.

Claim 18 defines a method corresponding to the apparatus defined by Claim 10 and is therefore allowable for at least the same reasons.


For the reasons stated above, it is requested that all the rejections and objections be withdrawn and that this application be allowed in a timely manner.

In the event that there are any questions concerning this Amendment, or the application in general, the Examiner is respectfully urged to telephone the undersigned attorney so that prosecution of the application may be expedited.

Respectfully submitted,

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